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Conference Abstract

Automated Methods in Digitisation of Pinned Insects

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Abstract

Digitisation of natural history collections draws increasing attention. The digitised specimens not only facilitate the long-term preservation of biodiversity information but also boost the easy access and sharing of information. There are more than two billion specimens in the world's natural history collections and pinned insect specimens compose of more than half of them (Tegelberg et al. 2014, Tegelberg et al. 2017). However, it is still a challenge to digitise pinned insect specimens with current state-of-art systems. The slowness of imaging pinned insects is due to the fact that they are essentially 3D objects and associated labels are pinned under the insect specimen. During the imaging process, the labels are often removed manually, which slows down the whole process. How can we avoid handling the labels pinned under often fragile and valuable specimens in order to increase the speed of digitsation?

In our work (Saarenmaa et al. 2019) for T3.1.2 task in the ICEDIG (https://www.icedig.eu) project, we first briefly reviewed the state-of-the-art approaches on small insect digitisation. Then recent promising technological advances on imaging were presented, some of which have not yet been used for insect digitisation. It seems that one single approach will not be enough to digitise all insect collections efficiently. The approach has to be optimized based on the features of the specimens and their associated labels. To obtain a breakthrough in insect digitisation, it is necessary to utilize a combination of existing and new technologies

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in novel workflows. To explore the options, we identified six approaches for digitising pinned insects with the goal of minimum manipulations of labels as follows.

1. Minimal labels: Image selected individual specimens without removing labels from the pin by using two cameras. This method suits for small insects with only one or a few well-spaced labels.
2. Multiple webcams: Similar to the minimal labels approach, but with multiple webcams at different positions. This has been implemented in a prototype system with 12 cameras (Hereld et al. 2017) and in the ALICE system with six DSLR cameras (Price et al. 2018).
3. Imaging of units: Similar to the multiple webcams approach, but image the entire unit ("Units" are small boxes or trays contained in drawers of collection cabinets, and are being used in most major insect collections).
4. Camera in robot arm: Image the individual specimen or the unit with the camera mounted at a robot arm to capture large number of images from different views.
5. Camera on rails: Similar to camera in robot arm approach, but the camera is mounted on rails to capture the unit. A 3D model of the insects and/or units can be created, and then labels are extracted. This is being prototyped by the ENTODIG-3D system (Ylinampa and Saarenmaa 2019).
6. Terahertz time-gated multispectral imaging: Image the individual specimen with terahertz time-gated multispectral imaging devices.

Experiments on selected approaches 2 and 5 are in progress and the preliminary results will be presented.

Keywords

digitisation, automation, 3D imaging, pinned insects, 3D digitizaton

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